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Mean Areas and Heliographic Latitudes of Sun-spots in the Year 1889, deduced from Photographs taken at Greenwich, at Dehra Dûn (India), and in Mauritius.

(*Communicated by the Astronomer Royal.*)

The results here given are in continuation of those printed in the *Monthly Notices*, vol. xlix. p. 380, and are deduced from the measurements of solar photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn, India, and at the Royal Alfred Observatory, Mauritius.

Table I. gives the mean daily areas of umbræ, whole spots, and faculæ for each synodic rotation of the Sun in 1889, and Table II. the same particulars for the entire year. The areas are given in two forms: first, projected areas—that is, as seen and measured on the photographs, these being expressed in millionths of the Sun's apparent disc; and, next, areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere. Table III. exhibits for each rotation in 1889 the mean daily area of whole spots, and the mean heliographic latitude of the spotted area, for spots north and for spots south of the equator, together with the mean heliographic latitude of the entire spotted area, and the mean distance from the equator of all spots; and Table IV. gives the same information for the year as a whole.

Table I.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas. Projected. Umbræ.	Projected. Whole Spots.	Projected. Faculæ.	Corrected for Foreshortening. Umbræ.	Corrected for Foreshortening. Whole Spots.	Corrected for Foreshortening. Faculæ.
	d							
471	1888 Dec. 15·33	26	3·8	30·8	107	2·9	23·9	121
472	1889 Jan. 11·66	26	4·0	27·8	57·2	2·5	16·6	76·2
473	Feb. 8·00	27	5·9	33·6	75·1	3·4	20·0	79·6
474	Mar. 7·34	27	7·1	41·1	116	6·3	37·8	137
475	Apr. 3·64	27	4·7	32·7	38·9	2·7	18·7	46·9
476	Apr. 30·90	27	2·7	15·2	66·7	2·4	16·6	80·5
477	May 28·12	27	44·5	245	79·0	29·0	160	84·3
478	June 24·31	27	50·0	277	128	37·4	214	165
479	July 21·52	25	73·9	448	280	54·8	345	343
480	Aug. 17·74	27	22·4	122	131	17·9	101	175
481	Sept. 14·00	27	14·4	77·7	125	10·4	58·6	151
482	Oct. 11·28	28	0·2	2·6	72·1	0·1	1·9	93·0
483	Nov. 7·58	27	0·0	0·0	45·0	0·0	0·0	58·0
484	Dec. 4·89	27	14·1	81·9	166	12·7	76·3	214

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TABLE II.

Year.	No. of Days on which Photographs were taken.	Mean of Daily Areas. Projected. Umbræ.	Projected. Whole Spots.	Projected. Faculæ.	Corrected for Foreshortening. Umbræ.	Corrected for Foreshortening. Whole Spots.	Corrected for Foreshortening. Faculæ.
1889	360	17·9	103	107	13·1	78·0	131

The rotations in Table I. and Table III. are numbered in continuation of Carrington's series (Observations of Solar Spots made at Redhill by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853 November 9. The assumed prime meridian is that which passed through the ascending node at mean noon on 1854 January 1, and the assumed period of the Sun's sidereal rotation is 25·38 days. The dates of the commencement of the rotations are given in Greenwich civil time, reckoning from mean midnight.

TABLE III.

No. of Rota-tion.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Spots North of the Equator. Mean of Daily Areas.	Spots North of the Equator. Mean Heliographic Latitude.	Spots South of the Equator. Mean of Daily Areas.	Spots South of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
471	1888, Dec. 15·33	26	0·0	° ...	23·9	− 6°·63	− 6°·63	6°·63
472	1889, Jan. 11·66	26	2·8	+ 10·16	13·8	− 3·60	− 1·28	4·71
473	Feb. 8·00	27	0·0	...	20·0	− 7·18	− 7·18	7·18
474	Mar. 7·34	27	31·6	+ 6·08	6·2	− 7·16	+ 3·92	6·26
475	Apr. 3·64	27	17·6	+ 3·32	1·1	− 0·95	+ 3·06	3·18
476	30·90	27	0·0	...	16·6	− 2·03	− 2·03	2·03
477	May 28·12	27	0·0	...	160	− 5·94	− 5·94	5·94
478	June 24·31	27	0·0	...	214	− 6·64	− 6·64	6·64
479	July 21·52	25	7·6	+ 2·69	338	−13·78	−13·42	13·54
480	Aug. 17·74	27	0·0	...	101	−19·18	−19·18	19·18
481	Sept. 14·00	27	0·0	...	58·6	−21·08	−21·08	21·08
482	Oct. 11·28	28	1·6	+22·70	0·3	−25·20	+15·34	23·08
483	Nov. 7·58	27	0·0	...	0·0	...	...	...
484	Dec. 4·89	27	6·2	+24·27	70·0	−20·90	−17·21	21·17

TABLE IV.

Year.	No. of Days on which Photographs were taken.	Spots North of the Equator. Mean of Daily Areas.	Spots North of the Equator. Mean Heliographic Latitude.	Spots South of the Equator. Mean of Daily Areas.	Spots South of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
1889	360	5·0	+7°·26	73·0	−11°·90	−10°·68	11°·61

The foregoing tables would appear to show that the actual Sun-spot minimum fell during the past year. The mean daily

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spotted area for the year as a whole was decidedly smaller than for 1888, whilst towards the end of the year there was a marked tendency for spots to form in high latitudes, so that the mean distance from the equator of all spots was considerably greater than in 1888. As Professor Spoerer has pointed out, the appearance of spots in high latitudes usually indicates the commencement of a new cycle. If the present be an example of this rule, then the new cycle may be taken as commencing in June 1889; for there were no instances of spots in latitudes higher than 10° until June 29, when a spot appeared in S. lat. 40°. At the same time the mean daily spotted area increased notably, for whilst it was only 22·5 for the first six rotations of 1889, as against 89 for 1888, it rose to 202 for the four following rotations. On the other hand, however, there have been but few spots since this outburst came to an end, and it may eventually prove to have been a mere accidental and temporary revival, and not the true commencement of the new cycle. The course of the solar activity during the next few months can hardly fail to decide the point.

Totality of the Eclipse of 1889 *December* 22. By David P. Todd.

(*Communicated by Dr. Huggins.*)

I located the eclipse expedition just north of Cape Ledo, a bold bluff on the West African coast, about 75 miles south of Saint Paul de Loanda.

Totality was completely lost in clouds, but a brief general description of the apparatus for the total eclipse, and of the novel method of operating it, will not be inappropriate.

Three essentials were recognised: (1) A great variety of apparatus; (2) large-scale pictures of the corona; (3) perfect clockwork. I saw no better way to meet these conditions than by constructing an equatoreal stand sufficiently capacious to accommodate all, or nearly all, the photographic apparatus. Accordingly, a split polar axis was built of 6-inch wrought-iron tubes, about 11 feet long, and placed 2 feet apart. The whole was mounted English fashion, on massive cast-iron supports, capped with brass bearings. This was built by Mr. Saegmueller, of Washington, and I was fortunate in obtaining from him the loan of a very perfect and powerful clockwork to drive it. This latter was in process of construction for the great equatoreal refractor of the Denver Observatory, and I found its centrifugal governor, a triple-twist flexible steel spindle, to perform with the highest accuracy. Also, the means provided by Mr. Saegmueller for adjusting the polar axis into parallelism with the earth's axis proved to be very neat; and the adjustment was readily made so close that, with an hour's run of the clock, the declination error on the plate did not exceed 20″.